

## Solar technology

The intent of using different solar technologies is to encourage the use of on-site renewable energy sources in order to reduce environmental and economic impacts associated with power generated from coal, natural gas and nuclear power. Solar energy is essentially free but requires special equipment to capture and convert to a usable form of energy. Two common types of systems are electrical (photovoltaic) systems and solar thermal systems.

### Electrical systems (Photovoltaic PV)

Solar photovoltaic systems come in all shapes and sizes. There are small ones built into garden path lighting. There are roof shingles that have built in solar collectors. There are huge systems that cover acres of land such as the 14 megawatt 72,000 panels at Nellis Air Force Base. The two main types of photovoltaic panels are flat plate with crystalline silicone which is more efficient and more expensive or thin film modules which can be flexible and are less expensive but also less efficient.

The basic concept of photovoltaic technology is described by NASA by following this link:

<http://science.nasa.gov/science-news/science-at-nasa/2002/solarcells/>.

For additional background refer to

<http://en.wikipedia.org/wiki/Photovoltaics>

The amount of electricity generated by a photovoltaic system is dependent upon several factors primarily system size, orientation of the system and shading. Typically, a 1 kilowatt PV system in Minnesota, using about 120 square feet of solar panels, will generate about 1,300 kWh per year. The average Minnesota household uses about 8,000 kWh per year.



For additional information and incentives visit Xcel Energy - Solar Panel Frequently Asked Questions.

[http://www.xcelenergy.com/Minnesota/Company/Pages/SelectAState.aspx?p=http://www.xcelenergy.com/Minnesota/Residential/RenewableEnergy/Solar\\_Rewards/Pages/faqs.aspx](http://www.xcelenergy.com/Minnesota/Company/Pages/SelectAState.aspx?p=http://www.xcelenergy.com/Minnesota/Residential/RenewableEnergy/Solar_Rewards/Pages/faqs.aspx)

or visit the State's Energy Information Office at

<http://www.state.mn.us/portal/mn/jsp/content.do?subchannel=-536895046&id=536893809&agency=Energy>

## Solar thermal systems

Solar thermal technology can be utilized to capture solar energy to heat water or air for use within the building. These systems are typically used in addition to traditional heating equipment for preheating thereby reducing the amount of electricity or fuel required. In general, these systems can be either passive or active depending on the needs of the building. Passive solar water heating [http://en.wikipedia.org/wiki/Solar\\_water\\_heating](http://en.wikipedia.org/wiki/Solar_water_heating) systems are generally simpler and less costly however are best suited for use in moderate climates with abundant sunshine. Active solar water heating [http://en.wikipedia.org/wiki/Solar\\_water\\_heating](http://en.wikipedia.org/wiki/Solar_water_heating) systems are more complex systems that typically require pumps, controllers, and additional piping and are therefore more expensive to install and maintain. The tradeoff is that active systems can be used effectively in more severe climates with less sunshine.

## Solar financing

The initial investment for the required equipment can be high but local utilities and other sources at times offer rebates or incentives to reduce the installation costs. For example Xcel Energy currently offers the following incentive:

[http://www.xcelenergy.com/Minnesota/Business/RenewableEnergy/Solar\\_Rewards/Pages/home.aspx](http://www.xcelenergy.com/Minnesota/Business/RenewableEnergy/Solar_Rewards/Pages/home.aspx)

The Minnesota State Office of Energy Security has additional incentive information:

<http://www.state.mn.us/portal/mn/jsp/home.do?agency=Energy>

## Geothermal heating, water heating and air conditioning

Geothermal systems use the temperature of the earth to heat in winter and cool in summer. In Minnesota the ground temperature range for a geothermal installation is moderately warm...42-55 degrees. For an existing structure in the city, there would likely be land constraints and a deep vertical installation would be necessary which is more expensive to install but, because the exterior underground portion of the system can be expected to last at least 50 years, there is ample time to achieve a return on the investment.

[http://www.energysavers.gov/your\\_home/space\\_heating\\_cooling/index.cfm/mytopic=12640](http://www.energysavers.gov/your_home/space_heating_cooling/index.cfm/mytopic=12640)

There are several configurations to choose from in using geothermal. In example:

- A coil inside a fan housing would be similar to what is traditionally used for air conditioning. The geothermal coil could warm or cool the air.
- A heat exchanger to a hot water heater can pre-heat the incoming water to save on the water heating bill. This can draw off additional heat making an even better cooling source for air conditioning in the summer.
- Radiant heating or cooling systems work well with geothermal. For instance, radiant ceiling panels might be an option that could be added while keeping an existing system to fulfill the indoor comfort needs during more severe weather.

The State of Minnesota conducted a study and the 'simple payback' period was between 20 and 30 years for geothermal systems installed for existing commercial buildings. 'Simple paybacks' are estimated using today's fuel cost. If fuel costs increase, then the time needed to recoup the initial investment would be shorter. Always ask about the fuel costs being used when ever you are getting an estimate on a "payback' period or return on investment analysis. Check the State information site for incentives:

<http://www.state.mn.us/portal/mn/jsp/content.do?id=-536893811&agency=Energy>

## Small wind systems

To install a wind system requires evaluation of the site and the wind source especially in a city. The following links have information that can help you decide if you want to pursue a more site specific evaluation.

The City of Minneapolis has specific zoning requirements for wind energy systems.

[http://www.ci.minneapolis.mn.us/council/2007-meetings/20070629/docs/07-2\\_CodeTextWindTurbine-JWid.pdf](http://www.ci.minneapolis.mn.us/council/2007-meetings/20070629/docs/07-2_CodeTextWindTurbine-JWid.pdf)

For detailed information on wind system installation and financial resources see the State of Minnesota's handout at:

[http://www.state.mn.us/mn/externalDocs/Commerce/Small\\_Wind\\_Project\\_Resources\\_050710123807\\_SmallWindProjects.pdf](http://www.state.mn.us/mn/externalDocs/Commerce/Small_Wind_Project_Resources_050710123807_SmallWindProjects.pdf)

For information on community wind systems see:

<http://www.windustry.org/blog/%5Buser%5D/minnesota-at-forefront-of-community-power-movement>

**Disclaimer:** Green Building Ideas for Existing Commercial Buildings contains links to many outside sites. These links are set up to provide information that is currently available. The City of Minneapolis cannot guarantee the accuracy of information found at any linked site. Providing links to outside sites does not constitute an endorsement by the City of Minneapolis



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Questions? Contact [Vicki.Carey@ci.Minneapolis.mn.us](mailto:Vicki.Carey@ci.Minneapolis.mn.us) or visit the website at <http://www.ci.minneapolis.mn.us/ccs/greenbuilding.asp>

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